E/CONF.39/D/24
29 Sept. 1962
ORIGINAL : ENGLISH

UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.5.1

United Kingdom

THE UTILIZATION OF TROPICAL PRODUCTS FOR PULP PAPER AND BUILDING BOARD PRODUCTION

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The Utilisation of Tropical Products for Pulp Paper and Building Board Production

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Since this paper will be entirely concerned with the utilisation of material derived from living plants, it can be said that the raw material requirements for pulp, paper and building board manufacture are essentially similar since they all need to possess to a greater or lesser extent a cellulosic fibrous structure. In fact the dividing line between some pulps used to produce very low grade papers (e.g. the mechanical and semi-chemical pulps) and those used to produce boards which require a pulping process is not very easily drawn. Here it is very largely a question of quality (and cheapness) and very briefly the higher the quality of the product the more exacting is the pulping process and the specification of the raw material. In general the considerations which concern raw materials for pulp would also apply to those for these types of board (i.e. boards which have been given the designation "fibreboard" and which are marketed under a large variety of trade names)

The exception is those building boards which are produced by binding un-pulped cellulosic material together with either a synthetic resin (particle board or chipboard) or with an inorganic binder such as cement or plaster (e.g. plaster board, wood-wool slabs). Here no pulping process is involved but is replaced by a rather specialised (for timber at any rate) flaking or chipping process to make the particles of suitable dimensions. As will be seen with paper and board, timber is at present the most widely used and preferred material and many commercial plants in Europe and the U.S.A., are possibly just as exacting in their timber requirements as are the pulp makers. There is a rather greater scope here with agricultural and non-timber materials but it must be remembered that a particle (or chip) specially engineered for the purpose will always make a better quality board than will a natural "particle" (e.g. a waste nut shell) which was designed for an entirely different purpose. A great deal more research is needed on various aspects of particle board manufacture from both timber and non-timber materials. Some such work is at present in progress at the Tropical Products Institute, that on groundnut shells has already been published, and reports on other tropical agricultural residues and timbers will follow.

3. Two surveys of the experimental pulp and paper making activities of the predecessors of the Tropical Products Institute (i.e. The Imperial – now Commonwealth – Institute and the Colonial Products Advisory Bureau-Plant and Animal) have been published, one by Furlong and Hill (1) and the other by Coomber (2). Between them these two papers describe the large amount of work carried out at this Institute alone on the pulping properties of a very large number of species (almost all naturally occurring rather than of agricultural waste or forest plantation origin). It is also

(1) Furlong J.R. and Hill E.L., Paper Making Materials of the British Empire, Bull. Imp. Inst. 42 (1944).

(2) Coomber H.E. Pulping Studies with Colonial Tropical Hardwoods as Paper Making Materials F.A.O. Forestry and Forest Products Studies. No.3, 51-62 (1952).

immediately obvious from these papers that the bulk of the experimental work on the evaluation of tropical raw material at the Institute since its foundation at the end of the last century has been devoted to timber. This trend is also to be found in the post-war reports of the T.P.I. and of other research laboratories of continental countries (e.g. the old Regie Industrielle de la Cellulose Colonial en France, the Royal Tropical Institute in Holland, the laboratories of the Ministry of Colonies in Belgium and the Forest and Forest Products Research Laboratory in Germany to mention only a few) who have been engaged on similar work. A study of the publications and conference report of F.A.O. concerned with this subject also confirms this trend. This is not to indicate that non-timber raw materials are unimportant as potential pulp and paper making materials in the tropics but rather to accentuate the fact that in practice the number of these non-timber materials which are utilisable is quite small. In fact the present commercial exploitation of these materials in the tropics is virtually limited to three, two of them being agricultural residues (bagasse and rice straw) and the other being bamboo. Because the consideration of these non-timber materials is so closely associated with other industries and because there is already such a large measure of published commercial and technical information on them it is not proposed to deal with them further in the paper.

4. Returning to the utilisation of tropical timber for pulp, paper and board a further analysis of the literature referred to in general terms above reveals that, within the reported material on timber, there is a definite pattern in this research work. For a period immediately before and after the second world war there was considerable pulping research activity on materials which have together become known as "mixed tropical hardwoods", which are obtained from naturally occurring tropical high forest. The most marked feature of this tropical high forest from which this material originates is the enormous number of species present: for example, in Malaya out of some 3,000 wood species, nearly 600 reach timber size and any one acre of natural forest may contain trees of up to 100 different species. Comparable figures apply to tropical forests in other parts of the world.

5. Out of this enormous number only a handful can find a market today; in a number of tropical territories, (for example, Trinidad, Malaya and Uganda) local consumption is reaching a point where an increasing number of species, if of reasonable form, can be marketed locally for timber. This is assisted by the increasing use of preservative treatment. On the other hand in territories such as British Guiana, British Honduras, West Africa, Borneo and Sarawak current exploitation is based on selective export markets. It is, of course, understood that a much higher price can be obtained for timber for use as such than for use as pulpwood.

6. For many years to come only a small but gradually increasing proportion of the natural stand is likely to be utilised for timber. To what extent can the residuals be used for production of pulp or reconstituted building board? It is now generally accepted that there is little technical difficulty in pulping heterogeneous mixtures of tropical hardwoods, at least by the sulphate process. This has been ascertained by many research workers and also on a small commercial scale at the Bimbresso project on the French Ivory Coast. However, very extensive experimental programmes using these mixed timbers have been carried out in the Philippines and by Belgian and Dutch workers. A very large mass of factual data has been built up on material of this type from all over the tropics, the work of Peel (3) on Malayan timbers, Istas (4) on Congo timber, Peteri (5) on West African timbers, of a number of South American workers at

(3) Peel J.D. Pulp and Paper Manufacture in Malaya Parts I-V Malayan Forester, 22, 62-89, 23, 255-286 (1959-1960) and 20, 187-196 (1959).

(4) Istas J.R. et al Etude de quelques bois congolais Publications de l'Institut National pour l'Etude Agronomique du Congo Belge, Serie Technique No.59 (1959)

(5) Peteri R. Pulping Studies with African Tropical Woods F.A.O. Forestry and Forest Products Studies No.3, 43-50 (1952).

the Latin American Meeting of Experts on the Pulp and Paper Industry in 1944 (6) and of the present author (7) which represents only a very small selection of that which has been published. Commercial exploitation has not followed and as far as is known, there is now no commercial mill in the world (the Ivory Coast project has now closed down) which uses a large number of species (i.e. more than about ten) as its normal raw material. The reasons for this are not difficult to find, the varying densities and chemical composition of these timbers, for example, impose restrictions on the choice of pulp production processes. For instance, the presence of an appreciable proportion of high density or highly resinous timber would make some semi-chemical processes difficult. This restriction of choice of process may pose further problems in underdeveloped countries owing to the limited range of naturally-occurring chemicals. These are almost essential because they play an important part in the economics of pulping. Further, the quality of this mixed hardwood pulp is such that it is doubtful whether it could be freely sold on the world's pulp market in competition with that produced from the large managed coniferous forests of N. America, Scandinavia and elsewhere. Many of the countries which are faced with this problem have at present only a small "all grades" pulp and paper consumption and are unlikely, for many years, to be able to utilise more than a small amount of this locally mixed material.

7. The extraction from the natural stands of large timber of this type for pulp wood is likely to be expensive; many of the species are non-floaters, so cheap water transport is impossible. Much of the timber is over-mature and often contains a large proportion of fungally attacked timber, which is not discovered until it is chipped, while there is a tendency in tropical conditions for the timber to deteriorate rapidly on the forest floor or in the log-yard.

8. All these factors tend to make the cost of pulp wood from this source expensive, while the cost of pre-pulping treatment of this material would also tend to be high. In general therefore one may conjecture that the probability of economic pulping of these mixed residuals is not high and that better prospects are afforded by the products of managed tropical forests. This is rather borne out by the fact that, during the last five years or so research efforts on tropical timber utilisation for pulp have swung away from work on mixed species towards what can be described as "selection". This work can be classified into that which has been on a close study of individual species of the tropical high forest and that which has been devoted to a study of species (both deciduous and coniferous) which are potentially useable for growing in pulpwood plantations. In fact, there is a lot to be said for the rather over-simplified statement that as soon as selection (for pulpwood that is) is envisaged it would almost certainly be advisable to manage the natural forest completely or, better still, cultivate the more desirable pulp producing species in a plantation.

9. The various aspects of these subjects have already been adequately discussed and summed up by Peel (3) by Coursey and Chittenden (8) and by the present author (7). The general conclusion is that, as far as the tropics are concerned the existence of large areas of unmanaged tropical high forest (and very often of other naturally occurring vegetation) does not necessarily mean that there also exists a readily available source of material for pulp, paper and board. In the great majority of cases the raw material source for such industries will have to be derived (with the exceptions mentioned above)

(6) Report of the Latin American Meeting of Experts on the Pulp and Paper Industry F.A.O. E.T.A.P. No.462 (1954).

(7) Swabey C. and Chittenden A.E. Potentialities of Tropical Forest in the World's Timber Economy 5th World Forestry, Congress, Seattle, (1961).

(8) Coursey D.G. and Chittenden A.E. Pulp and Paper Research in Nigeria, World Paper Trade Review, 157, 203-208 (1962).

from plantation timber or from managed natural forest. The complete utilisation of managed forests needs outlets for thinnings and so on which are otherwise useless for traditional industrial purposes. Such material, however, would be a near ideal source of good pulp, since it possesses very few of the inherent disadvantages of the heterogeneous natural stands. They have, in fact, arisen from a selection process.

10. It is not possible to discuss the relative technical merits of deciduous and coniferous timbers for pulp, paper and board manufacture but there appears to be no doubt that pulpwood plantations in the tropics can be established in surprisingly short periods of time. It is considered most important, therefore, that at the outset of the investigation of a pulp paper or board making project a forester should take an active part because from historical, technical and economic considerations he will almost certainly have to be relied upon as the producer of the mill's basic raw material. Further, the heterogeneous high forest should be looked upon as a source of lumber rather than of pulpwood and efforts should be made, as soon as a pulp project is envisaged, to get one of the many research Institutes working in this field to recommend (and if necessary investigate) species which can be grown in plantation either specifically for pulpwood or in conjunction with new afforestation schemes, i.e. species which would be available as thinnings.

ACKNOWLEDGEMENTS

The author acknowledges the assistance of Mr. C. Swabey, C.M.G. of the Department of Technical Co-operation in preparing this paper and the permission of the Director of the Tropical Products Institute, D.S.I.R. to submit it.

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